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# FOREIGN TECHNOLOGY DIVISION

ULTRASOUNDS IN THE TREATMENT OF RESULTS OF TRAUMATIC LESIONS AND THEIR COMPLICATIONS

BY

E. I. Locowa



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# ULTRASOUNDS IN THE TREATMENT OF RESULTS OF TRAUMATIC LESIONS AND THEIR COMPLICATIONS

From the Scientific-Research Institute of Traumatology and Orthopedy in Ryga. Director: Prof. W.K. Kalnberz, a corresponding member of the Academy of Medical Sciences USSR.

The problem has been discussed on the basis of results of investigations carried on 24 rabbits and of treatement of 84 patients.

Ultrasounds found an application in medicine due to their manifold impact on various processes in the organism. In numerous works authors point out the possibilities of normalizing, stimulating and disadvantageous and destructive influence. Taking into consideration negative reactions application of higher doses used during first years of treatment were gradually given up, and investigators concluded that only doses with a low and medium intensity are suitable.

On the basis of accepted methodological suggestions, particularly in a treatement of traumatic lesions the intensity of .2 - 1 $Wt/cm^2$ is considered to be optimal. However a necessity arose to ascertain more precise and most efficient dosing dependent upon the character and the course of results of a trauma.

Because of that I conducted investigations in that direction, taking into account actual problems of the impact of ultrasounds on reparative, osteogenetic and reproductive processes in acute and lingering post-traumatic mattery diseases of a bone..

The first part of the work I based on the model of a fibular fracture of a rabbit and I decided to investigate the reaction of the fractured bone to the influence of ultrasound, and to ascertain the dependence of that reaction on the intensity of the action and to work out practical recommendations.

The experimental animals, (their number being 24), were divided into 6 groups, (4 in each group,); one of them being a control group. In the first group of experimental animals, according to a commonly accepted labile methodology, with the use of vaseline oil, I used the the intensity of the ultrasounds at the level of .2 Wt/cm$^2$; in the second one .4 Wt/cm$^2$; in the third one .6 Wt/cm$^2$; in the fourth one .8 Wt/cm$^2$; in the fifth one 1.0 Wt/cm$^2$. The number of oscillations - 890 khc. Behavior of animals and the evaluation of periodically taken X-rays pictures constituted the control of the efficiency of the treatment. I was beginning the application of ultrasounds during the second 24 hours following the operation, and I was repeating it every day for 10 minutes. A series consisted of 10-12 treatments. I found that the animals subjected to the influence of small doses of ultrasounds behaved calmly during treatments, as distinguished from the rabbits which received large doses. Those last rabbits were frquently shaking and moving their paws away. The paralel analysis of X-ray pictures demonstrated the presence of clear reparative reactions in the damaged bone in response to the influence of ultrasounds. Those reactions were clearer in the cases of applications of low intensity doses, (.2 - .4 Wt/cm$^2$), and consisted of a uniform formation of the regenerate with the process of consolidation ending in 4 weeks. In the control group I obtained the same result in 5 weeks. With the application of the high intensity ultrasounds (.6 - .8 Wt/cm$^2$,) on the 21st day after the operation I was noticing in the vicinity of the fracture a rich osteoplastic reaction, mainly priosteal, more clear depending upon the dosage and in comparison to control animals and to rabbits which received low intensity doses. Asides form that, the ending of the formation of callus was taking place more slowly. Consolidation of the bone was taking place 7 weeks following the trauma. Also the irritant impact of those doses on the splinterbone in the neighbourhood of the fracture was noticed. After the end of the experiment we killed the animals. Histological preparations confirmed the results of the radiological examonations; (prof. A.Z. Amelin.)

The results of the experiment allowed ot fromulate concrete guideleines concerning the use of the low intensity ultrasonunds (.2 - .4 Wt/cm$^2$) in the clinic for the purpose of stimulating and regulating influence on reparative osteogenetic processes during uncomplicated course of the illness, and the doses of medium intensity (.6 Wt/cm$^2$) in cases of retarded consolidation.

I sewed the skin wound with a catgut. I fastened the free endings of threads on muslin rollers. Since the animals frequently used to eat the rollers together with threads, wounds in many of them were healing under conditions of an infection through granulation. Nevertheless I ascertained a quick disappearance of swelling of the tissue in the operated region, the lack of a mattery secretion, and healing of the skin wound through the formation of a scar which was poorly visible, elastic and was not grown into one with the foundation of the scar. Respectively to the applied intensities in the first two groups of animals, the wounds were healing 2 weeks earlier than the damaged bone and 5 - 7 days faster than in the control group.

On the basis of the above described observations, and also on the basis of information from the literature applying to the clear-cut antiswelling and anti-inflammatory influence of ultrasounds, and about their selective rejuvenating impact on on connective tissue with the predominance of the formation of elastic fibers with the exact dosing of intensity - we applied that method in the clinic.

The second part of our investigations applies to results of observations of 84 patients with complications in a form of a felon a cicatricial posttraumatic suppuration who were directed to the Institute for a consultation for the purpose of assessing possibilities of retaining sick fingers and the use of the hand, in connection with pains, lingering mattery wounds and a long term lack of success of the treatement. In those patients, with the cooperation of E.M. Zakis we used ultrasounds of above mentioned frequency in the water environment; (we degasified water through getting it to the point of boiling and then we cooled it to the level of the body temperature). Water as the enviroment of the contact simultaneously provided for clearing of the surface of the wound, improved trophicity of tissues and favored an early beginning of excercises which were possible. The apparatus was put in a distance of up to 2 cm from the surface of the wound.

Labile Methodology. Series consisted of 10 - 20 treatments lasting 10 - 12 minutes each. After treatments we were putting a dressing with a solution of nitrofurans on the surface of the wound (with taking into consideration the sensitivity of the micro-flora to that drug.) Thnaks to the complex treatement which was conducted, the patients avoided a renewed operation. All of the

patients returned to the work they were previously performing. Rehabilitation periods were counted from the moment of the beginning of the treatment in the Institute. In cases of bone felons they lasted 3–4 weeks, joint felons 4–6 weeks, cicatricial suppuration up to 6 weeks.

I compared the efficiency of the treatment among those patients with the results achieved under the influence of an electric field, ultra high frequency field and ultraviolet rays in erythema doses for analogous conditions.

Following the influence of the ultrasounds among analyzed patients exactly after the first treatment sleep was returning, ailments were decreasing, sintery tissues separeted earlier, including also bone sinters. Elastic scar was not grown to the foundation.

On the basis of observations of our patients we ascertained that the intensity of ultrasounds in treatement of suppurative conditions of a hand depends directly on the intensity of clinical symptomes. Even within the limits of small doses the intensity has to be selected individually for each patient, from .05 - .2 $Wt/cm^2$ during first treatements, to .6 $Wt/cm^2$ during the period of scar formation. As a criterion of an inappropriate dose we take feeling of pricking and expansion of the tissue in the wound as related by the patient.

Generalizing the results of conducted observations one has to emphasize the general impressions of a high level efficiency of ultrasounds in treatment of traumas and their complications. Specification of efficient treatment doses facilitates more exact investigations of the influence of that physical factor and also widening of the scope of the suggestions concerning its application.

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ULTRASOUNDS IN TREATMENT OF TRAUMATIC LESIONS AND THEIR COMPLICATIONS

Summary

Dosage and power of ultrasounds applied in treatment of traumatic lesions and their complications were investigated. It was showed on the experimental model of the fibular fracture of the rabbit that ultrasounds were sufficient in the power of 0.2—0.4 $W/cm^2$ but if the fracture healing was slac.. in the power of 0.6 $W.cm^2$. In treatment of the hand infections the ultrasound power should be assort for every patient individually. It depends on exacerbation of the clinical features and hesitates from 0.05—0.2 $W.cm^2$ in the initial stage of the treatment, to 0.8 $W.cm^2$ in the scar forming stage

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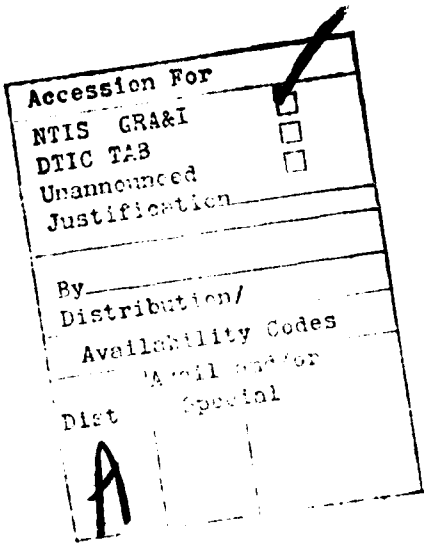

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